SUPERCOOLING OF THERMOELECTRIC DEVICE USING A CURRENT PULSE

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In a thermoelectric cooler, the Peltier cooling is hampered by Joule heating in the thermoelectric elements, such that a maximum temperature difference, \Delta T, is achieved at a particular current I {max}. During steady state operation, if the current is increased above I {max}, the increase Joule heating will be greater than the increased Peltier cooling resulting in a net decrease of \Delta T. However since Peltier cooling occurs instantaneously at the cold junction, while Joule heating occurs throughout the thermoelectric elements, there will be a short period where the cold junction is supercooled before the Joule heating reaches the cold end. In this way, a current pulse applied to a cooler running at maximum \Delta T can temporarily achieve and additional \Delta T {pulse} , due to the current pulse.

Such a cooler has been built using (Bi,Sb) {2} Te {3} materials and tested for its pulse cooling properties. A pulse cooling of 15K has been achieved. The response profile and the important material and geometric parameters will be discussed and compared to theoretical predictions. Applications include cooling of an infra-red laser for gas sensing.

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